

**DEVELOPING DEVICE**

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Inventor(s): TARUMI NORIYOSHI; others: 04  
Applicant(s): RICOH CO LTD  
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**Abstract**

**PURPOSE:** To obtain stable images for a long time by providing a roll which is brought into contact with a sleeve, from which a toner is supplied to a transfer material to terminate transfer, to scrape the unused toner on the sleeve and flowing back the scraped toner to a hopper.

**CONSTITUTION:** The toner in a hopper 2 is agitated by an agitator 4 and is supplied to a sleeve 1 by a toner supply roll 5. A front end part 6c of a blade consisting of an elastic material is brought into contact with the sleeve 1 to distribute the toner on the sleeve 1 uniformly with a prescribed thickness. The sleeve 1 is rotated in the direction of an arrow A to transfer the toner to a transfer material 7 in a transfer part D. The sleeve 1 is rotated furthermore and is brought into contact with a toner scraping roll 10 in a part R, and the unused toner is scraped and is moved in the direction of an arrow through a part N close to the toner supply roll 5 and is flowed back into the hopper 2. Thus, flocculation of the toner is prevented, and stable images are obtained for a long time.

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**CLAIMS**

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[Claim(s)]

[Claim 1] In a developer which carries out lamination of the developer to latent-image support, supplies it to it, and forms a latent image into a visible image A developer conveyance roller which conveys a developer in accordance with a predetermined circulation path including a development field, A reservoir means to store a developer, and a developer supply means to supply a developer currently stored by said developer reservoir means to said developer conveyance roller, It has a developer removal means to carry out a pressure welding to said developer conveyance roller by the hand-of-cut upstream of said developer conveyance roller of the contact section of said developer conveyance roller and said developer supply means, and to remove a developer of said developer conveyance roller surface. Said developer removal means a roller in which the surface section was formed with a flexible porous material -- providing -- \*\*\*\* -- and the surface -- said developer conveyance roller surface and this direction -- and a developer characterized by rotating to said developer conveyance roller and hard flow so that it may move at a speed quicker than said developer conveyance roller surface.

[Claim 2] It is the developer characterized by said flexible porous material being foaming polyurethane in the 1st term of a patent claim.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

Technical field this invention relates to details more about the developer which uses an one component system developer at the suitable developer for the development method using a nonmagnetic one component system developer.

There are a method using the binary system developer containing a toner and a carrier and a method using the one component system developer which does not contain a carrier as dry-developing method adopted as electrophotography, electrostatic recording, etc. conventionally [ conventional technical ]. It is stabilized comparatively and a good image is obtained, but on the other hand it is easy to generate deterioration of a carrier, fluctuation of the mixing ratio of a toner and a carrier, etc., and the former method has a difficulty in the maintenance nature of equipment, or miniaturization.

Then, the one component system developer which does not have a defect like \*\*\*\* attracts attention. An one component system developer makes a toner contain the magnetic substance, when making the material equivalent to a carrier have contained and usually moving a toner into a toner using magnetism. However, since the magnetic substance is opaque, it is difficult for it for it to be influenced of the coloring matter in color development, and to obtain a clear color picture. Therefore, although the method using the nonmagnetic developer which does not contain the magnetic substance is suitable to especially color development, how in this case, it is made to move in accordance with a predetermined path smoothly, and a developer is recycled poses a problem, and various technical problems arise along with this.

Eye-like this invention is made in view of the above point, and also when using a nonmagnetic developer, it aims at being stabilized, being able to acquire advanced image quality and offering the large developer of an application range suitable also as an object for color development.

Style In the developer which carries out lamination of the developer to latent-image support, supplies it to it, and forms a latent image into a visible image in order for \*\*\*\*\* to make the above-mentioned purpose attain The developer conveyance roller which conveys a developer in accordance with a predetermined circulation path including a development field, A reservoir means to store a developer, and a developer supply means to supply the developer currently stored by said developer reservoir means to said developer conveyance roller, It has a developer removal means to carry out a pressure welding to said developer conveyance roller by the hand-of-cut upstream of said developer conveyance roller of the contact section of said developer conveyance roller and said developer supply means, and to remove the developer of said developer conveyance roller surface. Said developer removal means the roller in which the surface section was formed with the flexible porous material -- providing -- \*\*\*\* -- and the surface -- said developer conveyance roller surface and this direction -- and it is characterized by rotating to said developer conveyance roller and hard flow so that it may move at a speed quicker than said developer conveyance roller surface.

Hereafter, based on the example of this invention, it explains concretely. Drawing 1 is a typical cross section having shown the developer which uses the nonmagnetic one component system developer as one example of this invention. In drawing 1, bearing of the rotation of the development sleeve 1 as a

developer conveyance object is made free, and a rotation drive is carried out at predetermined speed in the direction of arrow head A by this example. As shown in drawing 2, the development sleeve 1 puts insulating-layer 1b which consists of insulating materials, such as a chloroprene, on conductive base 1a peripheral surfaces, such as the shape of a sleeve, for example, aluminum etc., and the laminating of the electrode layer 1c which an electric insulation condition is made to distribute many electrode particles 1c1 mutually, and changes on it further is carried out, and it is constituted. Much microelectrodes can form easily electrode layer 1c distributed to homogeneity by carrying out distributed mixing of the electrical conducting materials, such as carbon black as an electrode particle 1c1, at homogeneity, and applying this charge of an admixture to insulating materials, such as an epoxy resin, on insulating-layer 1b in this case. Metal powders, such as copper, can also be used as a material of the electrode particle 1c1. Moreover, although broad materials, such as acrylic, an urethane system, a styrene system, an acrylic urethane system, epoxy silicon, or an epoxy Teflon system, can be used as a dispersion-medium object material which makes an insulating condition distribute these electrically mutually, it is required that the frictional electrification sequence over the toner with which frictional electrification of the toner as a developer is carried out efficiently and to be used should be [ like ] separated. Like the above, by forming electrode layer 1c which distributed the electrode particle 1c1 as a surface layer of the development sleeve 1, also when using an one component system toner, image concentration can acquire the suitable development property by the edge effect which goes up alternatively by the line drawing image. Moreover, since insulating materials, such as an epoxy resin which made low resisting media, such as carbon black as an electrode particle, distribute, have good adhesion with a toner compared with a metal etc., they can support sufficient amount also with the developer with which support force, such as special magnetism, does not involve like a nonmagnetic one component system toner, and can be conveyed with it. In addition, conductive base 1a is connected to bias power supply 9 with the electric discharge brush 8 and this potential which are mentioned later. Moreover, insulating-layer 1b is prepared in order to hold the field strength suitable for development, and omitting if needed is also possible. By this example, the hopper 2 which stores a developer in a drawing Nakamigi side is formed to the development sleeve 1. The developer used by this example is a nonmagnetic one component system toner. Opening 2a is formed in the upper part of a hopper 2, it is equipped with the cartridge 3 with which the toner was filled up here, and a new toner is supplied by natural fall towards a hopper 2. In the hopper 2, the agitator 4 sent out towards the development sleeve 1 surface is arranged free [ rotation ], preventing condensation of a toner.

The toner feed roller 5 as a developer supply means to promote migration of a up to [ the development sleeve 1 surface of a toner ] is arranged in the outlet side which supplies a toner to the development sleeve 1 of a hopper 2 free [ rotation ]. Suitably, it is desirable in the development sleeve 1 and this direction to carry out drive rotation while bearing of the toner feed roller 5 is carried out to the development sleeve 1 surface in the surface in the location in which a pressure welding is possible. That is, in the contact section C, the condition of moving to hard flow is desirable, both surfaces carrying out a pressure welding. While a toner is compressed among both surfaces and frictional electrification is efficiently carried out by this, thickness is regulated, and adhesion formation of the toner layer of moderate thickness is carried out on the development sleeve 1 surface. even if it is alike and arranges the toner feed roller 5 in a non-contact condition to the development sleeve 1, the appropriate thing [ supplying a toner to the development sleeve 1 ] is possible, and the same effect as the case where it is made to contact can be acquired by preparing a press member separately, using a toner with sufficient electrification effectiveness, and using together methods, such as carrying out adhesion formation of the toner layer. Moreover, although the peripheral velocity with the suitable surface of the toner feed roller 5 changes with peripheral velocity of the development sleeve 1, its condition of rotating setting it as high speed and \*\*\*\*ing the toner feed roller 5 surface on the development sleeve 1 surface from the development sleeve 1 on the whole is desirable. if it is alike and sets up at high speed too much, since [ appropriate ] it will be accompanied by side effects, such as toner scattering and promotion of condensation of the toner within toner fixing and the hopper 2 in bearing, to set up within proper limits is demanded. As for the quality of the material of the surface section of the toner feed roller 5, it is

desirable for the frictional electrification sequence to be separated to a toner in order to carry out frictional electrification of the toner efficiently.

while the sponge roller 5 on which the surface layer to which whenever [ foaming ] changes from flexible material, such as 10-100, for example, polyurethane foam etc., with the number of cells suitable for a peripheral surface in this example was put carries out a pressure welding to the development sleeve 1 surface -- the development sleeve 1 and this direction -- a drive -- it is arranged pivotable. In this case, to the development sleeve 1 whose diameter is 25.4mm rotating at the rate of 400rpm, the toner feed roller 5 whose diameter is 14mm rotates by 800rpm, and the ratio of both peripheral velocity is set as about 10:11. In addition, in order to move a toner to the optimum dose [ every ] contact section C and to form a suitable toner layer in the development sleeve 1 surface, the higher one of the degree of hardness of flexible material is good, and the smaller one of a foaming aperture is good [ a degree of hardness ]. In addition, as a material of the surface layer of a roller 5, not only flexible material but other various materials, such as a rubber metallurgy group, are usable.

Like the above, by forming the toner feed roller 5, the toner which is stored in a hopper 2 and sent out with rotation of an agitator 4 follows rotation of the toner feed roller 5, and is smoothly transported to the contact section C. The toner transported between the development sleeve 1 which moves to hard flow mutually, and each surface of the toner feed roller 5 is compressed, and while frictional electrification is carried out in this case, a toner is made to adhere to the development sleeve 1 surface in the contact section C. In this case, as force of making rotation of the toner feed roller 5 following, the electrostatic force by friction with a toner and the toner feed roller 5 etc. mainly involves. Therefore, even if it is the case where the special support force is not set up excluding a carrier or the magnetic substance like the nonmagnetic one component system toner in a developer, either, migration supply can be smoothly carried out on the development sleeve 1 surface from a hopper 2.

The doctor blade 6 which regulates and carries out lamination of the thickness of the toner layer which adhesion formation is carried out on the development sleeve 1 surface, and is conveyed with the rotation is arranged in the downstream of the toner feed roller 5 along the hand of cut of the development sleeve 1. The doctor blade 6 of this example puts insulator layer 6b which consists of fluorine system resin, such as for example, a tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA), on one side of main part 6a which consists of an elastic member, is formed in it, makes the development sleeve 1 surface carry out the pressure welding of that point through this insulator layer 6b, and regulates the thickness of a toner. In this case, although which direction of the direction of a counter opposite to a hand of cut like this example is sufficient as the support direction of a doctor blade 6, as for it, it is important for the direction of trailing supported along the hand of cut of the development sleeve 1, or reverse to make tip edge section 6c contact the development sleeve 1 surface. This becomes certainly possible over the abbreviation whole region of a necessary range [ in / for the thickness of a toner / the cross direction of the development sleeve 1 ] to be able to regulate to homogeneity and to form the uniform toner thin layer of thickness stably. Moreover, insulator layer 6b is prepared in order to aim at fixing prevention of a toner and improvement in an electrification property, like this example, by using a fluorine system material, fixing of a toner is prevented more effectively and frictional electrification is carried out.

organic [ of the shape of endless / as latent-image support stretched free / rotation / by the proper place of the downstream of the doctor blade 6 in the rotation path of the development sleeve 1 ] -- a sexual feeling -- the phaosome belt [ some ] (OPC belt) 7 and development sleeve 1 surface carries out rolling contact, and the development field D is formed. The electrostatic latent image formed in the surface of the OPC belt 7 through the production process of uniform electrification and image exposure in the proper place is conveyed to the development field D with the rotation. While thickness is regulated with a doctor blade 6 by the development field D, the toner thin layer to which frictional electrification of enough charges was carried out is supported by the surface of the development sleeve 1, and is conveyed to it. In this case, since electrode layer 1c of the surface section of the development sleeve 1 is formed by insulating materials, such as an epoxy resin to which a toner tends to adhere, as mentioned above, over the necessary field of a peripheral surface, the developer with which special support force, such as

a nonmagnetic one component system toner, is not set up can also be supported equally, and can convey it. Therefore, a toner thin layer with uniform thickness is stabilized and supplied to the electrostatic latent image formed in the OPC belt 7, and a latent image is formed into a visible image by homogeneity.

The electric discharge brush 8 from which the unnecessary charge accumulated in the development sleeve 1 surface is removed is arranged in the downstream along the hand of cut of the development sleeve 1 of the development field D. The orientation for the charge charged in unnecessary polarity to be accumulated in development by friction with the toner feed roller 5, a doctor blade 6, and OPC belt 7 grade is shown in the development sleeve 1 surface. Since this unnecessary charge becomes the cause of generating a poor image, such as natural complexion dirt and a stripe, to remove certainly is demanded. Especially the charge accumulated in insulating materials, such as an epoxy resin which is the material of electrode layer 1c of the development sleeve 1, is difficult to remove compared with the case of a metal etc., and an efficient electric discharge means is required. In this example, the length and attaching position of the quality of the material and the electric discharge brush 8 are set up so that the tip abdomen of conductive brush hair 8a can contact the development sleeve 1 surface by the moderate pressure by the elasticity of itself. Thereby, brush hair 8a can contact rear-spring-supporter homogeneity to the necessary field of the cross direction of the development sleeve 1 surface, and the good electric discharge effect without electric discharge nonuniformity can be acquired. And the electric discharge brush 8 is connected to bias power supply 9 with the same potential as conductive base 1a of the development sleeve 1 mentioned above. The charge of the residual toner with which the unnecessary stored charge or the development of the development sleeve 1 surface were not presented by this is efficiently removable alternatively.

It \*\*, and it is arranged in the location which adjoined the upstream of the toner feed roller 5 by the downstream of the electric discharge brush 8 to the hand of cut of the development sleeve 1 pivotable free, the toner extra jacket roller 10 as a developer removal means to return the toner which remains on the development sleeve 1 surface in the scraping hopper 2 contacting the development sleeve 1. In this case, it is desirable to set up the hand of cut of the extra jacket roller 10 so that both surface may move in this direction in the development sleeve 1 and the toner feed roller 5, an opposite direction R, i.e., the contact section with the development sleeve 1, and the contiguity section N with the toner feed roller 5, respectively. In accordance with the \*\*\*\* path shown by the arrow head B which collaborates with the toner feed roller 5 by this the toner scratched in the contact section R, and passes along the contiguity section N, it can return smoothly, and contributes to condensation prevention of the toner within a hopper 2. Moreover, as for the peripheral velocity, it is desirable that it is quicker than the peripheral velocity of the development sleeve 1, thereby, the surface of the toner extra jacket roller 10 is made to \*\*\*\* on the surface of the development sleeve 1, and a residual toner can be scratched efficiently. since [ appropriate ] it is alike and side effects, such as toner scattering, are accompanied by too much improvement in the speed like the above-mentioned toner feed roller 5, to set it as a suitable speed is demanded.

Covering formation of the surface section 10b which consists of foaming polyurethane on the peripheral surface of rodding 10a bearing of the rotation of was made free is carried out, and drive rotation of the toner extra jacket roller 10 of this example is carried out at the rate of predetermined towards the drawing Nakaya mark. If surface section 10b is formed with a flexible porous material like this example, by carrying out the pressure welding of the toner extra jacket roller 10 to the development sleeve 1, it can be made to be able to bend a little, field contact of both can be carried out, and it will become possible to scratch a residual toner certainly. Therefore, the residual toner which received electric discharge processing and disappeared the static electricity-adhesion force is conveyed with rotation of the development sleeve 1 in the arrangement location of the toner extra jacket roller 10, and fails to be scratched easily and certainly from the surface of the development sleeve 1 with the toner extra jacket roller 10 which \*\*\*\*s in the state of field contact here. The scratched toner passes along the contiguity section N in each rotation and \*\* of the toner extra jacket roller 10 and the toner feed roller 5, and is smoothly returned in a hopper 2 in accordance with the path shown by the arrow head B, and a reuse is

presented with it. Moreover, in order to fail to scratch the toner adhering to a roller, bar 10' is prepared in the toner extra jacket roller 10, and, thereby, the fall of extra jacket \*\*\*\*\* of a toner is prevented. Since a reuse is carried out once scratching certainly the toner returned after making it adhere to the development sleeve 1 surface and conveying to the development field D like \*\*\*\* from the development sleeve 1 surface, while fixing of a toner is prevented, the bad influence to the image by the reuse is controlled. In addition, as a material of surface section 10b of the toner extra jacket roller 10, not only flexible porosity material but flexible material metallurgy groups, such as rubber, etc. can be used. Moreover, if electric conduction processing of the circumferential surface of surface section 10b which contacts the development sleeve 1 at least is carried out and it connects with bias power supply etc. like the electric discharge brush 8, it will function also as an electric discharge means and it will also become possible to omit the electric discharge brush 8.

In the above-mentioned example, although the roller type was described as a developer removal means, it is also possible for it not to be limited to this, for example, to use a blade. Especially as a suitable blade member, polymeric materials or metal elastic bodies, such as polyurethane rubber, a fluororesin, or polyethylene, etc. are mentioned with rubber. Moreover, although the nonmagnetic one component system toner is used as a developer, this invention is applicable also to the developer not only using this but a magnetic toner. Furthermore, this invention is applicable also to the drum type latent-image support which has the rigidity of a photo conductor drum etc. Furthermore, it is good also as a configuration to which the development sleeve 1 surface is made to carry out the pressure welding of the doctor blade 6 moderately by the magnetism of the magnet which formed the doctor blade 6 with the elastic magnetic substance, and was arranged in the development sleeve 1 interior again.

Effect As explained in full detail more than \*\*, according to this invention, by forming separately a developer removal means to remove a developer from a conveyance object in the upstream of a developer supply means to promote supply of the developer to a developer conveyance object, in accordance with a predetermined path, circulation migration also of the developers, such as a nonmagnetic one component system toner with which the special support force for making it move is not set up, can be carried out smoothly, and an efficient predetermined development process can be carried out. Therefore, also in the developer which uses an one component system nonmagnetic toner, while being able to carry out the formation supply of the toner thin layer of the uniform thickness which has a required charge stably, fixing and condensation of a toner are controlled, and it becomes possible to acquire advanced image quality over a long period of time. In addition, this invention is not limited to the above-mentioned specific example, and it is needless to say for various deformation to be possible within the limits of [ technical ] this invention. For example, it is possible to apply this invention also to the method developed only by not contacting a developer conveyance object and latent-image support, and making it approach. Moreover, a developer supply means may be formed in the shape of an endless belt.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

The mimetic diagram having shown [ 1 ] one example of this invention and drawing 2 are explanatory drawings which expanded the part in one example of this invention, and were shown.

(Explanation of a sign)

- 1: Development sleeve
- 5: Toner feed roller
- 6: Doctor blade
- 10: Toner extra jacket roller
- 10b: Surface section

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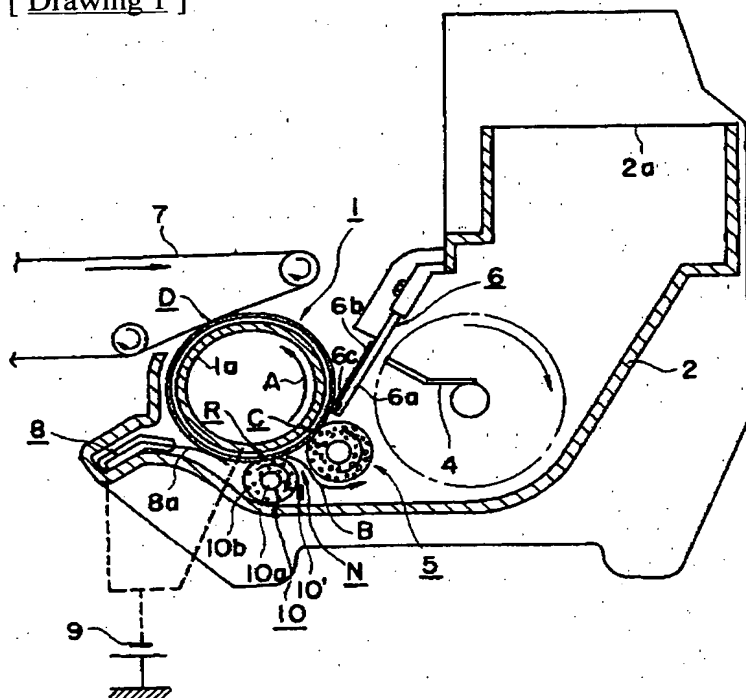
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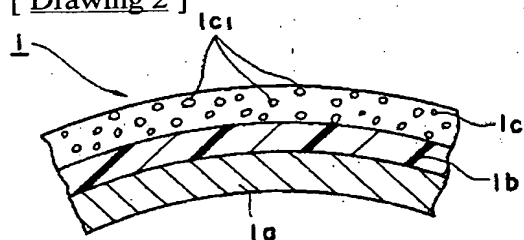
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## DRAWINGS

[ Drawing 1 ]



[ Drawing 2 ]



[Translation done.]

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(71)出願人 999999999

株式会社リコー

東京都大田区中馬込1丁目3番6号

(72)発明者 樽見 紀慶

東京都大田区中馬込1丁目3番6号 株式  
会社リコー内

(72)発明者 出水 広己

東京都大田区中馬込1丁目3番6号 株式  
会社リコー内

(72)発明者 小夫 真

東京都大田区中馬込1丁目3番6号 株式  
会社リコー内

(74)代理人 弁理士 小橋 正明

審査官 芝 哲央

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(54)【発明の名称】 現像装置

## 【特許請求の範囲】

【請求項1】潜像担持体に現像剤を薄層化して供給し潜像を可視像化する現像装置において、現像剤を現像領域を含む所定の循環経路に沿って搬送する現像剤搬送ローラと、現像剤を貯留する貯留手段と、前記現像剤貯留手段に貯留されている現像剤を前記現像剤搬送ローラに供給する現像剤供給手段と、前記現像剤搬送ローラと前記現像剤供給手段との接触部の前記現像剤搬送ローラの回転方向上流側で前記現像剤搬送ローラに圧接し前記現像剤搬送ローラ表面の現像剤を除去する現像剤除去手段とを有しており、前記現像剤除去手段は、表面部が可撓性多孔質材料で形成されたローラを具備しており且つその表面が前記現像剤搬送ローラ表面と同方向へ且つ前記現像剤搬送ローラ表面よりも速い速度で移動するように前記現像剤搬送ローラと逆方向に回転することを特徴とす

る現像装置。

【請求項2】特許請求の範囲第1項において、前記可撓性多孔質材料は発泡ポリウレタンであることを特徴とする現像装置。

## 【発明の詳細な説明】

## 技術分野

本発明は、一成分系現像剤を用いる現像装置に関し、より詳細には、非磁性の一成分系現像剤を用いる現像方式に好適な現像装置に関するものである。

## 従来技術

従来、電子写真や静電記録等に採用される乾式現像方法には、トナーとキャリアとを含む二成分系現像剤を用いる方法と、キャリアを含まない一成分系現像剤を用いる方法がある。前者の方法は、比較的安定して良好な画像が得られるが、その反面、キャリアの劣化及びトナーと

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キャリアとの混合比の変動等が発生し易く、装置の維持管理性やコンパクト化に難点がある。

そこで、上述の如き欠点を有しない一成分系現像剤が注目される。一成分系現像剤は、通常、トナー中にキャリアに相当する物質を含有させてあり、磁力を利用してトナーを移動させる場合は、トナーに磁性体を含有させる。ところが、磁性体は不透明であるから、カラー現像においてはその色素の影響を受け鮮明なカラー画像を得ることが難しい。従って、特にカラー現像に対しては、磁性体を含まない非磁性現像剤を用いる方法が適しているが、この場合、現像剤を如何にして円滑に所定経路に沿って移動させリサイクルするかが問題となり、これに付随して種々の課題が生じる。

#### 目 的

本発明は、以上の点に鑑みなされたものであって、非磁性現像剤を使用する場合も高度の画像品質を安定して得ることができカラー現像用としても好適な応用範囲の広い現像装置を提供することを目的とする。

#### 構 成

本発明は、上記の目的を達成させるため、潜像担持体に現像剤を薄層化して供給し潜像を可視像化する現像装置において、現像剤を現像領域を含む所定の循環経路に沿って搬送する現像剤搬送ローラと、現像剤を貯留する貯留手段と、前記現像剤貯留手段に貯留されている現像剤を前記現像剤搬送ローラに供給する現像剤供給手段と、前記現像剤搬送ローラと前記現像剤供給手段との接触部の前記現像剤搬送ローラの回転方向上流側で前記現像剤搬送ローラに圧接し前記現像剤搬送ローラ表面の現像剤を除去する現像剤除去手段とを有しており、前記現像剤除去手段は、表面部が可撓性多孔質材料で形成されたローラを具備しており且つその表面が前記現像剤搬送ローラ表面と同方向へ且つ前記現像剤搬送ローラ表面よりも速い速度で移動するように前記現像剤搬送ローラと逆方向に回転することを特徴としたものである。

以下、本発明の実施例に基づいて具体的に説明する。第1図は本発明の1実施例としての非磁性一成分系現像剤を使用する現像装置を示した模式的断面図である。第1図において、現像剤搬送体としての現像スリーブ1が回転自在に支承されており、本例では、矢印A方向に所定速度で回転駆動される。現像スリーブ1は、第2図に示す如く、スリーブ状の例えばアルミニウム等の導電性基体1a周面上にクロロブレン等の絶縁材料から成る絶縁層1bを被着し、更にその上に多数の電極粒子1c<sub>1</sub>を互いに電氣的絶縁状態に分散させて成る電極層1cが積層され、構成されている。この場合、例えばエポキシ樹脂等の絶縁材料に電極粒子1c<sub>1</sub>としてのカーボンブラック等の導電材料を均一に分散混合し、この混合材料を絶縁層1b上に塗布することにより、多数の微小電極が均一に分散する電極層1cを容易に形成することができる。電極粒子1c<sub>1</sub>の材料としては、銅等の金属粉も使

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用できる。又、これらを互いに電氣的に絶縁状態に分散させる分散媒体材料としては、アクリル系、ウレタン系、スチレン系、アクリル-ウレタン系、エポキシ-シリコン又はエポキシ-テフロン系等の幅広い材料を使用できるが、現像剤としてのトナーが効率良く摩擦帯電される様に、使用するトナーに対する摩擦帯電系列が離れていることが要求される。以上の如く、現像スリーブ1の表面層として電極粒子1c<sub>1</sub>を分散させた電極層1cを形成することにより、一成分系トナーを使用する場合も線画像で画像濃度が選択的に上昇するエッジ効果による好適な現像特性を得ることができる。又、電極粒子としてのカーボンブラック等の低抵抗物質を分散せしめたエポキシ樹脂等の絶縁材料は、金属等比べてトナーとの付着性が良いから、非磁性一成分系トナーの様に特別な磁力等の担持力が関与しない現像剤でも充分な量を担持し搬送することができる。尚、導電性基体1aは、後述する除電ブラシ8と同電位でバイアス電源9に接続されている。又、絶縁層1bは、現像に適した電界強度を保持する為に設けてあり、必要に応じて省略することも可能である。

現像スリーブ1に対して、本例では図中右側に、現像剤を貯留するホッパ2が形成されている。本例で使用する現像剤は、非磁性の一成分系トナーである。ホッパ2の上部には、補給口2aが形成され、ここにトナーが充填されたカートリッジ3が装着され、ホッパ2に向けて新たなトナーが自然落下により補給される。ホッパ2内には、トナーの凝集を防止しつつ現像スリーブ1表面に向けて送り出すアジテータ4が回転自在に配設されている。

ホッパ2の現像スリーブ1にトナーを供給する出口側には、トナーの現像スリーブ1表面上への移動を促進する現像剤供給手段としてのトナー供給ローラ5が回転自在に配設されている。トナー供給ローラ5は、好適には、その表面を現像スリーブ1表面に圧接可能な位置に支承されると共に現像スリーブ1と同方向に駆動回転されることが望ましい。即ち、接触部Cにおいて、双方の表面が圧接しつつ逆方向に移動する状態が好ましい。これにより、トナーが双方の表面間に挟圧されて効率良く摩擦帯電されると共に層厚が規制され、適度な厚さのトナー層が現像スリーブ1表面に付着形成される。然るに、トナー供給ローラ5を現像スリーブ1に対して非接触状態に配設しても、トナーを現像スリーブ1に供給することは可能であり、帯電効率の良いトナーを用いるとか別個に押圧部材を設けてトナー層を付着形成させる等の方法を併用することにより、接触させる場合と同様な効果を得ることができる。又、トナー供給ローラ5の表面の好適な周速度は、現像スリーブ1の周速度によって異なるが、総体的には現像スリーブ1より高速度に設定し、現像スリーブ1表面にトナー供給ローラ5表面を摺接しつつ回転する状態が好ましい。然るに、過度に高速度に設

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定すると、トナー飛散や軸受部でのトナー固着及びホッパ2内でのトナーの凝集の促進等の副作用を伴う為、適正範囲内に設定することが要求される。トナー供給ローラ5の表面部の材質は、トナーを効率良く摩擦帯電させる為に、トナーに対して摩擦帯電系列が離れていることが望ましい。

本例では、周面に好適には発泡度がセル数で10～100の例えばポリウレタンフォーム等の可撓材から成る表面層が被着されたスポンジローラ5が、現像スリーブ1表面に圧接しつつ現像スリーブ1と同方向に駆動回転可能に配設されている。この場合、直径が25.4mmの現像スリーブ1が400rpmの速度で回転されるのに対して、直径が14mmのトナー供給ローラ5が800rpmで回転され、両者の周速度の比は、約10:11に設定されている。尚、トナーを適量ずつ接触部Cに移動させ好適なトナー層を現像スリーブ1表面に形成する為には、可撓材の硬度は高い方が良く、発泡孔径は小さい方が良い。尚、ローラ5の表面層の材料としては、可撓材に限らず、ゴムや金属等他の種々の材料も使用可能である。以上の如くトナー供給ローラ5を設けることにより、ホッパ2内に貯留されアジテータ4の回転と共に送り出されてくるトナーは、トナー供給ローラ5の回転に追従して円滑に接触部Cに移送される。接触部Cにおいては、互いに逆方向に移動する現像スリーブ1とトナー供給ローラ5の各表面間に移送されてきたトナーが挟圧され、この際に摩擦帯電されると共にトナーが現像スリーブ1表面に付着せしめられる。この場合、トナー供給ローラ5の回転に追従させる力としては、主にトナーとトナー供給ローラ5との摩擦による静電気力等が関与する。従って、現像剤が非磁性一成分系トナー等の様にキャリアも磁性体も含まず特別な担持力が設定されていない場合であっても、ホッパ2から現像スリーブ1表面に円滑に移送供給することができる。

現像スリーブ1の回転方向に沿って、トナー供給ローラ5の下流側には、現像スリーブ1表面に付着形成されその回転と共に搬送されてくるトナー層の層厚を規制して薄層化するドクタブレード6が配設されている。本例のドクタブレード6は、弾性部材から成る本体6aの一方の側面に例えばテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)等のフッ素系樹脂から成る絶縁膜6bを被着して形成されており、この絶縁膜6bを介してその先端部を現像スリーブ1表面に圧接させトナーの層厚を規制する。この場合、ドクタブレード6の支持方向は、現像スリーブ1の回転方向に沿って支持するトレーリング方向、或いは、逆に本例の如く回転方向とは反対のカウンタ方向の何れの方でもよいが、先端エッジ部6cを現像スリーブ1表面に当接させることが重要である。これにより、トナーの層厚を現像スリーブ1の幅方向における所要範囲の略全域にわたり確実且つ均一に規制することができ、層厚の均一

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なトナー薄層を安定的に形成することが可能となる。

又、絶縁膜6bはトナーの固着防止と帯電特性の向上を図る為に設けられており、本例の如くフッ素系材料を使用することにより、より効果的にトナーの固着が防止され摩擦帯電が実施される。

現像スリーブ1の回転移動経路におけるドクタブレード6の下流側の適所には、回転自在に張設された潜像担持体としての無端状の有機性感光体ベルト(OPCベルト)7の一部と現像スリーブ1表面が転動接触し、現像領域Dが形成されている。適所で一様帯電及び像露光の工程を経てOPCベルト7の表面に形成された静電潜像は、その回転と共に現像領域Dまで搬送される。現像領域Dには、ドクタブレード6により層厚が規制されると共に十分な電荷が摩擦帯電されたトナー薄層が現像スリーブ1の表面に担持され搬送されてくる。この場合、現像スリーブ1の表面部の電極層1cは、前述した如くトナーが付着し易いエポキシ樹脂等の絶縁材料で形成されているから、非磁性一成分系トナー等の特別な担持力が設定されていない現像剤も周面の所要領域にわたって均等に担持し搬送することができる。従って、OPCベルト7に形成された静電潜像に層厚が均一なトナー薄層が安定して供給され、均一に潜像が可視像化される。

現像領域Dの現像スリーブ1の回転方向に沿った下流側には、現像スリーブ1表面に蓄積された不要な電荷を除去する除電ブラシ8が配設されている。現像スリーブ1表面には、トナー供給ローラ5やドクタブレード6及びOPCベルト7等との摩擦により、現像に不要な極性に帯電された電荷が蓄積される傾向がある。この不要な電荷は、地肌汚れやスジ等の画像不良を発生させる原因となるので、確実に除去することが要求される。特に、現像スリーブ1の電極層1cの材料であるエポキシ樹脂等の絶縁材料に蓄積された電荷は、金属等の場合に比べて、除去が困難であり、効率の良い除電手段が要求される。本例においては、導電性ブラシ毛8aの先端腹部がそれ自体の弾性による適度な圧力で現像スリーブ1表面に当接できる様に、その長さや材質及び除電ブラシ8の取付位置が設定されている。これにより、ブラシ毛8aが現像スリーブ1表面の幅方向の所要領域にわたり均一に当接でき、除電ムラの無い良好な除電効果を得ることができる。そして、除電ブラシ8は、前述した現像スリーブ1の導電性基体1aと同一電位でバイアス電源9に接続されている。これにより、現像スリーブ1表面の不要な蓄積電荷や現像に供されなかった残存トナーの電荷を選択的に効率良く除去できる。

而して、現像スリーブ1の回転方向に対して除電ブラシ8の下流側でトナー供給ローラ5の上流側に隣接した位置には、現像スリーブ1表面に残存するトナーを掻き取りホッパ2内に返送する現像剤除去手段としてのトナー掻取ローラ10が、現像スリーブ1と接触しつつ自在に回転可能に配設されている。この場合、掻取ローラ10

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の回転方向を、現像スリーブ1及びトナー供給ローラ5と反対方向、即ち、現像スリーブ1との接触部R及びトナー供給ローラ5との近接部Nにおいて両者の表面が夫々同方向に移動する様に設定することが望ましい。これにより、接触部Rで掻き取られたトナーをトナー供給ローラ5と協働して近接部Nを通る矢印Bで示す如き経路に沿って円滑に返送でき、ホッパ2内でのトナーの凝集防止に寄与する。又、その周速度は、現像スリーブ1の周速度より速いことが望ましく、これにより、トナー掻取ローラ10の表面を現像スリーブ1の表面に摺接させて効率良く残存トナーを掻き取ることができる。然るに、過度な高速化は前述のトナー供給ローラ5と同様にトナー飛散等の副作用が伴うため、適切な速度に設定することが要求される。

本例のトナー掻取ローラ10は、回転自在に支承された芯金10aの周面上に発泡ポリウレタンから成る表面部10bが被着形成されており、図中矢印の方向に所定の速度で駆動回転される。本例の如く、表面部10bを可撓性多孔質材料で形成すれば、トナー掻取ローラ10を現像スリーブ1に対して圧接させることにより若干撓ませて両者を面接触させることができ、残存トナーを確実に掻き取ることが可能となる。従って、除電処理を受け静電氣的付着力を消失した残存トナーは、現像スリーブ1の回転と共にトナー掻取ローラ10の配設位置に搬送され、ここで面接触状態で摺接するトナー掻取ローラ10により、現像スリーブ1の表面から容易且つ確実に掻き落とされる。掻き取られたトナーは、トナー掻取ローラ10及びトナー供給ローラ5の夫々の回転と共に近接部Nを通り、矢印Bで示す経路に沿って円滑にホッパ2内に返送され、再使用に供せられる。又、トナー掻取ローラ10には、ローラに付着したトナーを掻き落とす為に、パー10'を設けてあり、これにより、トナーの掻取り能力の低下が防止される。

斯くの如く、現像スリーブ1表面に付着させて現像領域Dに搬送した後返送されてきたトナーを確実に現像スリーブ1表面から一旦掻き取った後再使用するから、トナーの固着が防止されると共に再使用による画像への悪影響が抑制される。尚、トナー掻取ローラ10の表面部10bの材料としては、可撓性多孔質材に限らず、ゴム等の可撓材や金属等も使用できる。又、少なくとも現像スリーブ1と接触する表面部10bの周表面を導電処理し、除電ブラシ8と同様にバイアス電源等に接続すれば、除電手段としても機能し、除電ブラシ8を省略する

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ことも可能となる。

上記実施例においては、現像剤除去手段としてローラタイプについて述べたが、これに限定されず、例えばブレードを使用することも可能である。好適なブレード部材としては、ゴムで特にウレタンゴム、フッ素樹脂若しくはポリエチレン等の高分子材料又は金属弾性体等が挙げられる。又、現像剤として非磁性一成分系トナーを用いているが、これに限らず磁性トナーを用いる現像装置に対しても本発明を適用することができる。更に、感光体ドラム等の剛性を有するドラム式潜像担持体に対しても本発明は適用可能である。更に又、ドクタブレード6を弾性磁性体で形成し現像スリーブ1内部に配設した磁石の磁力により、ドクタブレード6を現像スリーブ1表面に適度に圧接させる構成としてもよい。

#### 効果

以上、詳述した如く、本発明によれば、現像剤搬送体への現像剤の供給を促進する現像剤供給手段の上流側に現像剤を搬送体から除去する現像剤除去手段を別個に設けることにより、移動させる為の特別な担持力が設定されていない非磁性一成分系トナー等の現像剤をも円滑に所定経路に沿って循環移動させて効率良く所定の現像プロセスを実施することができる。従って、一成分系非磁性トナーを使用する現像装置においても、必要な電荷を有する均一な層厚のトナー薄層を安定的に形成供給できると共にトナーの固着や凝集が抑制され、高度な画像品質を長期間にわたって得ることが可能となる。尚、本発明は上記の特定の実施例に限定されるものではなく、本発明の技術的範囲内において種々の変形が可能であることは勿論である。例えば、現像剤搬送体と潜像担持体を接触させず近接させるだけで現像する方式にも本発明を適用することが可能である。又、現像剤供給手段は無端ベルト状に形成してもよい。

#### 【図面の簡単な説明】

第1図は本発明の1実施例を示した模式図、第2図は本発明の1実施例における一部を拡大して示した説明図である。

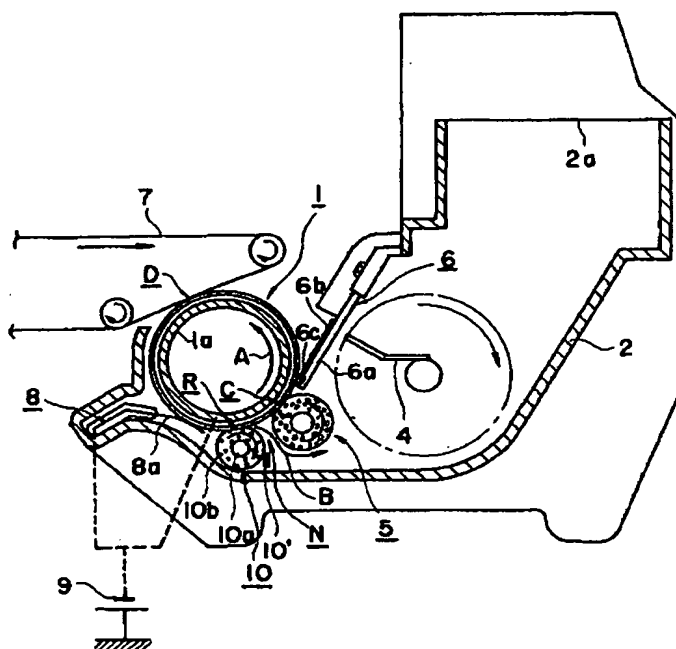
#### (符号の説明)

- 1：現像スリーブ
- 5：トナー供給ローラ
- 6：ドクタブレード
- 10：トナー掻取ローラ
- 10b：表面部

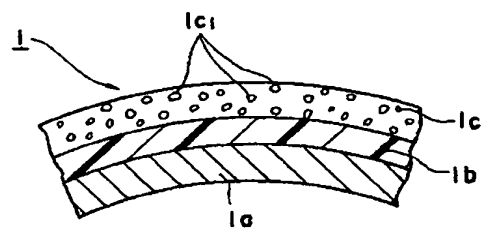
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【第 1 図】



【第 2 図】



フロントページの続き

(72) 発明者 矢野 英俊

東京都大田区中馬込 1 丁目 3 番 6 号 株式  
会社リコー内

(72) 発明者 清宮 龍文

東京都大田区中馬込 1 丁目 3 番 6 号 株式  
会社リコー内

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